

MASTER OF SCIENCE IN PHYSICAL OCEANOGRAPHY

BEDFORM EVOLUTION UNDER THE COMBINED INFLUENCES OF WAVES AND CURRENTS AT THE INNER-SHELF MISO SITE

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Observations of the temporal evolution of waves, currents, and bed response data collected by an instrumented frame deployed in 12m of water at the Monterey Inner Shelf Observatory (MISO) off the coast of Monterey, California are analyzed in terms of measured wave and current forcing statistics and ripple geometry. During the year 2000, a Broadband Acoustic Doppler Current Profiler (BADCP) collected continuous wave and current measurements. Bed morphology was continually mapped by a Scanning Acoustic Altimeter (SAA) in a 1m alongshore by 1.5m cross-shore area immediately offshore from the MISO frame. Relict ripples were observed to dominate the bedforms throughout much of the year. Ripple growth in the alongshore direction was observed during conditions of marginally critical flow as defined by the critical combined wave and current Shields parameter. As flow conditions increased above the critical level, ripple growth in the alongshore direction ceased, and cross-shore wavelengths began to grow and dominate. Together, these observations and data sets are used to evaluate the applicability of existing ripple prediction algorithms. Altogether, five models are tested, and it was concluded that they could not independently predict the bed's response.

KEYWORDS: Oceanography, Nearshore, Ripples, Bedform Evolution, Waves, Currents, Sediment Transport

ANALYSIS OF TEMPERATURE VARIABILITY BETWEEN DAVIDSON SEAMOUNT AND SUR RIDGE: THE TOMOGRAPHIC INVERSE PROBLEM

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As part of the Innovative Coastal-Ocean Observing Network (ICON), a receiver located on Sur Ridge monitored transmissions of low frequency tomography signals from a sound source on Davidson Seamount. The received signals were transmitted via underwater cable to the Point Sur Ocean Acoustics Observatory (OAO) from July 1998 through December 1999. Processed signals revealed a stable, resolvable arrival pattern. Subsequent analysis included forward acoustic modeling to calculate predicted raypaths. Observed arrivals were then associated with modeled raypaths, extracting observed travel times over the 17-month time series. Using a stochastic inverse approach, the extracted travel times were inverted for spatial and temporal variations of sound speed. Sound speed perturbation estimates were converted to temperature perturbations and compared to in situ mooring data, CTD transects along the acoustic path, and TOPEX/POSEIDEN satellite altimetry. Comparisons revealed that the tomographic estimate is in general agreement with the in situ point measurements and the altimeter data. The methods discussed in this paper demonstrate the application of ocean acoustic tomography to study temperature variability along the central California coast.

KEYWORDS: Acoustic Tomography, Oceanography, Monterey Bay, ICON

SIMULATION OF THE BOHAI SEA CIRCULATION AND THERMOHALINE STRUCTURE USING COHERENS MODEL

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The goal of this work is to simulate the Bohai Sea circulation and thermohaline structure and to investigate the physical mechanisms using the Coupled Hydrodynamical-Ecological Model for Regional and Shelf Seas (COHERENS) with realistic bottom topography and coastal geometry. The model-simulated seasonal variability of the circulation pattern and the thermal structure agree qualitatively with the observation. The salinity field is not as well simulated as the temperature. The thermohaline structure is vertically stratified during the summer monsoon. The sub-surface velocities are found to be compensating currents from the surface circulation.

Several experiments are performed to identify the prevailing forcing functions and Bohai Sea characteristics: (1) control run, with all the surface forcing functions (thermohaline fluxes, wind, tides) present, (2) no-thermohaline flux run, (3) no-wind run, and (4) no-tide run. The experiments show that the surface wind effect is the major forcing to drive the surface currents and the thermohaline structure, the thermohaline flux is the important driving force for the thermal structure, and the tidal mixing is responsible for the deep layer characteristics.

It is also found that a higher turbulence kinetic energy (TKE) is produced using the Mellor-Yamada turbulence closure scheme than the “k-e” scheme. The deeper regions present higher TKE at the surface than in shallow waters. Maximum TKE for July are greater than the maximum TKE in January.

KEYWORDS: Ocean Modeling, Simulation, Sensitivity Study, Primitive Equation Model, Shallow Sea, Circulation, GDEM, COHERENS, Sigma Coordinate, TKE

ENVIRONMENTAL VARIABILITY ON ACOUSTIC PREDICTION USING CASS/GRAB

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The goal of this research is to examine the environmental effects on shallow water bottom moored mine detection using the Navy's Comprehensive Acoustic Simulation System/Gaussian Ray Bundle (CASS/GRAB) model for a generic Very High Frequency (VHF) forward looking sonar. The effects of imprecise bottom type and wind speed data are evaluated to determine the impact of this variability on mine detection. The results show that signal excess variability is small and operational benefits may be maximized with a slightly better sonar. The effects of shallow and deep transducer placement in the water column are compared to determine which yields a greater probability of mine detection. The greatest probability of mine detection exists for the deep transducer.

KEYWORDS: CASS/GRAB, Modeling and Simulation, Oceanography, Mine Warfare